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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM
SOVIET-BLOC ACTIVITIES

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I. GENERAL

Report on Commission on the Physics of the Atmosphere

"The Commission on the Physics of the Atmosphere (KFA) under the Department of Physicomathematical Sciences, Academy of Sciences USSR (OFMN AN SSSR), was organized in 1953 (its chairman is A. M. Obukhov, Corresponding Member of the Academy of Sciences USSR) and is known also as the Section on Meteorology and the Physics of the Atmosphere under the Committee on Geodesy and Geophysics.

"The commission is staffed by representatives of institutions engaged in studies of the meteorology and physics of the atmosphere. Current work is conducted by a bureau consisting of five men. The mission and function of the commission are determined by a regulation confirmed by the Bureau of the Department of Physicomathematical Sciences Academy of Sciences USSR as of 22 May 1956:

"(1) To unify and coordinate scientific investigations being conducted on the physics of the atmosphere in various institutions, the commission conducts conferences and congresses on the most actual problems of the physics of the atmosphere. The plans of the conferences are approved by the Bureau of the Department of Physicomathematical Sciences of the Academy of Sciences USSR.

"(2) The commission draws into its own work specialists in contiguous fields who are interested in investigations on the physics of the atmosphere for the purpose of discussions on the objects of the investigations which are on the border between meteorology and other disciplines.

"(3) The commission fulfills the mission of the Committee on Geodesy and Geophysics on the arrangement of materials for the committee according to the division "Physics of the Atmosphere."

"(4) The commission, according to the mission of the Bureau of the Department of Physicomathematical Sciences Academy of Sciences USSR or on the initiative of the members of the commission, examines organizational problems connected with the development of investigations on the physics of the atmosphere and directs its recommendations to the Department of Physicomathematical Sciences, Academy of Sciences USSR, and interested institutions.

"During its existence, the commission, in addition to the various consultations on problems entering into its sphere has accomplished the following:

"(1) An expanded conference on problems of turbulence and the theory of climate;

"(2) A conference on the scintillation of stars (jointly with the Astrosovet [Astronomical Council, Academy of Sciences USSR]; the majority of the reports made at thic conference were published in periodicals;

"(3) A congress devoted to the problem on weather prognosis in which representatives of interested institutions, in particular representatives of GUGMS [Main Administration of the Hydrometeorological Service], took an active part;

"(4) A joint session of the Scientific Council of the Institute of the Physics of the Atmosphere and the Commission for the Physics of the Atmosphere in which the reports of the Soviet delegation taking part in the work of the 11th General Assembly of the International Geodetic and Geophysical Union were discussed;

"(5) In February 1958, in the expanded session of the commission, the report "Problems of the Study of the Atmosphere in Antarctica," by Prof B. L. Dzerdzeyevskiy, was discussed; representatives of the interested institutions and several members of the Antarctic expedition (S. P. Khromov, G. M. Tauber) were present at the session. In the course of the discussion, problems of cyclonic and anticyclonic circulation, runoff winds, and other problems were considered.

"A session on the problem of the prospects for the development of atmospheric optics and actionometry was held on 24 April 1958. Representatives of the Main Geophysical Observatory imeni Voyeykov (K. S. Shifrin and Yu. D. Yanishevskiy) and the Central Aerological Observatory (V. G. Kastrov) took part in it. A number of recommendations were worked out at the conference and were finalized in the adopted resolution. A subcommission on radiation composed of the following was selected: K. G. Kondrat'yev, (chairman), V. G. Kastrov, G. V. Rozenberg (deputy chairman), G. K. Sulakvelidze, K. S. Shifrin, and Yu. D. Yanishevskiy. This subcommission was charged with calling a conference on the optics of scattering media in 1958-1959.

"The Commission on the Physics of the Atmosphere accomplished a large amount of work on the composition of a report on scientific works on meteorology conducted in the USSR beginning with 1950. This report was published by the Committee for Geodesy and Geophysics and was presented at the International Association of Meteorology for the 11th General Assembly of the International Geodetic and Geophysical Union. The report contains a short description of the most important results in the field of meteorology and an extensive bibliography (1,051 titles).

"The Commission on the Physics of the Atmosphere took an active part in the preparations for the 11th General Assembly of the International Geodetic and Geophysical Union in accord with the International Association of Meteorology. Soviet scientists presented the assembly with nine reports on different divisions of meteorology and physics of the atmosphere. Abstracts of the reports were published by the Committee for Geodesy and Geophysics in a special brochure." ("In the Commission on the Physics of the Atmosphere" by F. F. Yudalevich; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 2, Feb 59, pp 335-336 -- full translation)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Soviet Space Plans Discussed

A description of the recent "cosmic rocket" launched by the Soviet Union on 2 January 1959, including details on launching time, orbit characteristics, and transmission frequency, is given in an article by Prof V. V. Petrovich. The author makes the following comments:

"The normal functioning of the scientific equipment made it possible to obtain important information which will be tabulated and published at a future date.

"A powerful improved ballistic rocket was used to create the 1.5-ton solar rocket. This rocket can be used to launch earth satellites of any weight up to several tons or to deliver loads of even greater weight to any point on the Earth's surface.

"Such improved rockets are distinguished by the high-load ratio of the design and the highly effective powerful engines, are equipped with systems which ensure optimum functioning of the unit, and use the most complete systems for stabilizing and controlling rocket flight.

"The successful flights of Soviet rockets are not unique chance events on a background of unsuccessful firings, but are the result of working out the design in a regular systematic fashion. Soviet rockets start without fail at a previously designated time and travel along precision programmed trajectories.

"The flight of a cosmic rocket to interplanetary space is a logical next step in studying and mastering the cosmos on the basis of the all-round development of rocket technology in the Soviet Union. Short-range rockets, intermediate-range rockets, intercontinental rockets, earth satellites, and finally the solar rocket -- these are already behind us....

"These notable achievements of the Soviet Union in the region of rocket construction mark only the beginning of a great road along which mankind will pass in his future development. It is now evident that in the next several years, the development of rocket technology will be concentrated in three principal areas of the study and mastery of the cosmos. These areas will be developed simultaneously.

"The first area is concerned with creating a number of artificial earth satellites of different tonnage and purpose. First among these is a group of satellites which will provide constant observation over the whole surface of the Earth and the air surrounding it. These are to be equipped with the complex scientific apparatus, both optical and televisional, necessary for this purpose. Such satellites will be extremely valuable in developing our knowledge of the Earth and the space around it. Naturally, the plane of the orbit of the observer-satellites will make a large angle with the Earth's equator in order to encompass the whole surface of the Earth with its observations.

"The safe, automatic descent of satellites or their essential parts to the Earth will be developed. This will be based essentially on the breaking force of the atmosphere, both with and without lifting surfaces (i.e. planning descent). After the safe descent of the equipment container has been worked out, and then the descent of a container with animals, man's turn will come for flight in an artificial satellite with return to earth.

"Further development in this area will bring richly equipped observer satellites, real stations outside the Earth, and cosmic laboratories and observatories. In time, these stations will fill additional functions connected with servicing the interplanetary flights of cosmic rockets.

"The average height of the artificial satellites above the Earth's surface will depend on the purpose of the satellite and the characteristics of its equipment. This height will vary within limits of from several hundred kilometers for the first observer satellites to thousands and tens of thousands of kilometers for the stations, which for example, service rockets in their interplanetary voyages.

"The second area in the study and mastery of the cosmos is concerned with the natural earth satellite, the Moon. A Soviet cosmic ship was put in orbit in such a way that it passed very close to the Moon's surface, at a distance of 1/70 of the distance from the Earth to the Moon. This flight marked only the beginning of a study of the closest heavenly body to us, the Moon. Later flights will allow for flight around the Moon, the photographing of its hidden side, and the transmission of images to Earth in the return path of the rocket. An artificial moon satellite, maintaining constant radio communication with the Earth, will be very valuable. By the flights of lunar rockets, cosmic space and all the

phenomena occurring within the radius of 500,000 kilometers of the Earth will be subject to careful investigation. As the successful flight of the Soviet cosmic rocket has shown, radio communication may be successfully maintained at distances from the Earth of the order of 500,000 kilometers and, it has now become clear, may be accomplished at even much greater distances.

"Study of the Moon will be substantially expanded by depositing on its surface scientific equipment with telemetric and televisional apparatus and radio stations for communication with Earth and transmission of scientific observations. To accomplish this, it is necessary to solve the problem of the safe descent of instrument containers to the Moon's surface. The absence of an atmosphere on the Moon in quantities having any practical value requires that the rocket engines of the final stage of the rocket or special braking rocket engines be used to reduce the approach velocity of the rocket and provide a sufficiently smooth landing to protect the equipment. To accomplish such a flight, a lunar rocket must first acquire a velocity close to the second cosmic velocity in order to reach the moon (desirably, with a certain excess with a sharply reduced flight time,) and then must reduce the velocity by approximately 3 kilometers per second in order to effect a shockless landing on the surface. Thus, a flight to the moon with a landing in which the velocity with which the rocket meets the moon surface is equal to zero requires a rocket with a total velocity equivalent to approximately 14.5 kilometers per second.

"The telemetric study of the properties of the lunar surface cannot give an exhaustive answer to all of the questions of interest to science. As one of these, we may consider the composition of lunar rock and its nature and origin. Therefore, the flight of a rocket with a man on board becomes logical and unavoidable. Investigating the structure of the lunar surface and taking on board the rocket samples of lunar rock for analysis in laboratories on the Earth will raise to a new and higher level work on the study of the closest heavenly body to us and will also provide much material for the study of geological and, possibly, cosmogenic processes in general. The absence of an atmosphere and water on the moon provides some basis for assuming that the structure of its surface, to some extent, is kept in its primordial form and has not been subjected to subsequent deposits under the action of water, wind, and glaciers, as has occurred under terrestrial conditions. The accumulation of experience in the safe landing of heavy containers of automatic scientific apparatus on the moon and the study of conditions prevailing there with the help of this apparatus will enable us to accumulate data necessary to accomplish the flight of man to the moon.

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"The autonomous flight of a man on board a research rocket with a landing on the Moon and a return to Earth is difficult due to energy considerations, since such a rocket must be able to develop a total equivalent flight velocity of the order of 3 cosmic velocities: for example, 11.2 kilometers per second to leave the Earth and reach the Moon, 3.3 kilometers per second for braking and landing on the Moon, and 2.4 kilometers per second in taking off from the Moon for return to Earth. The remaining velocity reserve is used up by the breaking of the atmosphere in landing on the Earth; considering the necessity of an additional energy supply on board the rocket for correcting the flight -- particularly in the return approach to Earth -- the necessary minimum total equivalent velocity will be slightly more than 17 kilometers per second.

"Flights with a man can be accomplished with less powerful rockets. All that is required here is to cast onto the Moon beforehand (with shockless landing) containers with the fuel supply necessary to refuel the rocket before its return to Earth. In this case, it is sufficient to put on board the rocket at the time of take-off from Earth a quantity of fuel necessary for the final stage to reach the Moon and provide safe landing on the Moon's surface. After completing the research program on the Moon and refueling the final stage of the rocket with fuel from the ship containers, return of the expedition to Earth can be successful.

"In view of the complexity of carrying out the cosmic flight of a man, it is possible to increase the chances of the safe departure of the expedition by launching two lunar rockets simultaneously. This will make it possible for both crews to help one another in preparing for the return flight on the Moon and, in the case of irreparable trouble on one of the rockets, for both crews to return in the same rocket.

"There is no doubt that the flight of a man around the moon with landing on the Earth will precede the flight of a man with landing on the Moon since the energy requirements are more within reach, it is less complex to complete, and, at the same time, it in itself presents great scientific possibilities.

"The third area in the study and mastery of the cosmos is concerned with the study of the planets of our solar system. At the present time, preparations can be made for flights of cosmic explorer rockets to Mars and Venus, the closest planets to us. The fact that, energetically speaking, such flights are completely within reach at the current stage of rocket development was demonstrated by the first interplanetary flight of the Soviet cosmic rocket, which occurred 2 January 1959. This rocket passed close to the Moon and approached the orbit of Mars.

"The purpose of the first interplanetary flights will be to approach as close as possible to the planet under investigation and to study its properties and then transmit the results of the observations to the Earth as the rocket approaches the Earth on its return flight.

"Interplanetary flights will be long. Flights even to the closest planets with return to Earth will take years (See "Basic Problems of Cosmonautics," G. V. Petrovich, Vestnik Akademii Nauk SSSR, No 6, 1958). Duration of flights can be considerably shortened by increasing the flight velocity through a decrease in the weight of the useful load. However, this approach can lead to a diminishing of the scientific value of the experiment.

"If it is considered that these flights to planets will be the first interplanetary flights, then we should not be disturbed by their length. The development of rocket technology and the building of rocket engines using more powerful energy sources than modern rocket engines will later open new possibilities. Flights to planets will become faster, and the choice of a suitable launching time will be less restricted than at present.

"It is well to remember that the first Earth-circling journey was made by Magellan's expedition, which required 3 years with great difficulties and deprivations. Also, all Earth-circling journeys up to the beginning of the present century took almost as much time; in any case, their length was measured in years. In our time, with the help of aviation, this trip can be accomplished in 2-3 days and, in case of necessity, even faster. Rocket technology makes it possible to fly around the Earth in 2 hours.

"In speaking of the duration of interplanetary flights, one should not forget the distances involved, which measure hundreds of millions and billions of kilometers. The probing and studying of the entire space around the Sun by automatic explorer rockets in the region of both the inner and outer planets is an obvious prerequisite to further penetration into the cosmos. In this connection, it is definitely of interest to create a number of artificial satellites of the Sun which will move along various given orbits and which are equipped with instruments and a constantly operating radio station powered by solar batteries. All three of these areas which we have considered for the study and mastery of the cosmos, namely, the further development of Earth satellites for various scientific purposes, the study of the Moon, and the accomplishment of interplanetary flights and the future creation of satellites of the Sun, require for their complete development constant progress in rocket technology and the development of even more effective rockets with greater launching weight. This is possible only under the condition that

more powerful engine installations are developed with increased specific thrust. In addition, stabilization and control systems must be improved, as must the whole complex of ground equipment for preparing and carrying out the launching. Only in this way can the prerequisites be met for successful penetration of the cosmos. Only by using heavy cosmos ships with sufficiently large useful loads may the problems of studying and conquering the cosmic spaces around us be solved successfully. Completion of the program of Earth satellites, lunar rockets, interplanetary ships, and solar satellites, will require the further development of the diverse scientific equipment for studying cosmic space and the improvement of multichannel telemetric radio equipment with high resolving power for the transmission of the results of the observations to the Earth from distances measuring in the several millions of kilometers.

"Investigations in space medicine should be given a wide scope, since the time is approaching when the solution of problems in this branch of knowledge must be made in terms of concrete recommendations.

"This program for the direct penetration of the cosmos was, in effect, proposed at the end of the last and the beginning of the present century by K. E. Tsiolkovskiy. In his classical works, Tsiolkovskiy described with his usual broad vision and striking boldness the way to the subsequent study and mastery of cosmic space with the use of every variety of heavenly body occupying it.

"Soviet scientists and builders who have dedicated themselves to this problem are students of Tsiolkovskiy and continuers of his great work. We have come only to the first stage of the excellent way indicated by Tsiolkovskiy for penetrating the boundless reaches of the world's space around us. And this road, as the road to the progress of mankind, has no end.

"Many Soviet scientists, builders, and technicians have devoted their lives to the taks of mastering the cosmos for the sake of the joy of understanding the Universe and for the sake of the good of mankind, and they rejoice that they live and work in the Soviet state which has presented them with all the capabilities of our highly developed socialistic science and industry to realize the most secret and daring hopes possessed by mankind even from the cradle of his development.

"We rejoice that we live and work in the country of Socialism where all thoughts of the leaders are directed towards preserving peace on our planet and beyond it and toward increasing the welfare of all workers through their own labor. The creators of the cosmic rocket, with a feeling of love and deep gratitude, have dedicated its successful launching to the 21st Congress of the CPSU, to the congress whose decisions pave the future road to happiness and abundance in our country, a road brightly lit by the sunshine of peace and friendship with all peoples of our marvelous planet.

"Workers of scientific research institutes, design bureaus, factories, and testing organizations which ensured the creation and launching of the cosmic rocket received with enthusiasm the speech of N. S. Khrushchev at the 21st Congress of the CPSU, in which he warmly congratulated them in the name of the party and the Soviet people.

"In answer to this gratitude, to the many congratulations arriving from all parts of our planet, scientists, specialists and workers, the creators of the rocket, are striving by persistent effort for new successes in their field. Let the artificial satellite of the Sun continue on its glorious path and proudly bear the banner with the state emblem of the Soviet Union and the anniversary date of its birth.

"The time will come when cosmic tourists of the future will enter the orbit of this first artificial planet in the world to view these emblems and render its due to the country which has made the good fortune of all mankind its banner. ("The First Artificial Satellite of the Sun," by Prof G. V. Petrovich; Moscow, Vestnik Akademii Nauk SSSR, No 3, Mar 59, pp 8-14)

Soviet Scientist Predicts Three-Stage Conquest of Moon

The next 10 years will see the beginning of the Moon's conquest by man, says Yu. Klebtsevich, Candidate of Technical Sciences. This will be accomplished in three stages, the first two of which will be made without man's flying to the Moon.

The first stage will be the flight of cosmic rockets, controlled from the Earth, impacting the Moon. These will be equipped with electrono-telescopic apparatus. While dropping toward the Moon, television pictures and the results of all kinds of measurements will be received and recorded on the Earth.

This stage will disclose geological details of the visible and invisible sides of the Moon and the density and composition of the lunar atmosphere and its temperature, and the presence of any form of organic life on the Moon will be determined.

Finally, the place for the landing of radio-controlled cosmic rockets in the next, or second, stage will be selected.

The second stage will be the landing of radio-controlled cosmic rockets on the Moon at the selected spot. These rockets will carry special apparatus and traveling tank-laboratories with televisional and measuring apparatus, which will be radio-controlled from the Earth. The most detailed investigations of the Moon will be conducted with the aid of these by scientists and specialists on Earth.

Television viewers in all the countries of the Earth will also be able to "travel" on the surface of the Moon since the transmission of the images on their screens through transmitting television centers will be, to a certain degree, similar to the usual on-the-spot television transmissions.

The possibility of people living on the Moon and the testing of biological safeguards from harmful actions will be more precisely determined during the second stage. The behavior of experimental animals delivered on the Moon will be studied by such a method.

The third stage is the creation of a permanent, manned station on the Moon. With the aid of the tank-laboratory, the site of the station will be selected, and its apparatus will be used as a radio beacon.

The station equipment, the facilities for ensuring the existence and work of the personnel on the Moon, and the rocket fuel for returning people to Earth will be delivered to the selected spot according to the second-stage program.

The erection of the station will be accomplished by means of the tank-laboratory, which will be equipped with special manipulators and controlled from the Earth by radio.

After such preparations, the first people will be placed on the Moon (according to the second-stage program; this will be a one-way flight fully controlled from the Earth).

Control over the condition of the astronauts during the flight and during their stay on the Moon will be done by means of the transmission of readings of instruments built into the protective clothing.

Reliable radio-television communication with the astronauts will be effected. In the case of unforeseen circumstances, supplementary supplies will be delivered from the Earth.

Fuel reserves stored on the Moon will be used for returning the astronauts to Earth, and, subsequently, rockets will be refueled in flight by rocket-fueling stations in a stationary orbit controlled from the Earth. The rocket, under full radio-control throughout the whole trip from Moon to Earth, after having partially expended its speed by braking in the Earth's atmosphere, will make a gliding landing.

In the third stage, preparations and provisions for ensuring the means of accomplishing regular trips of radio-controlled cosmic craft between the Moon and the Earth will be made.

It should be mentioned, says Klebtsevich, that the accomplishment of all these three stages requires considerably less expenditure than older projects. The plan observes maximum precautions for safeguard of life and undoubtedly shortens the length of time for disclosing the secrets of the Moon and for its conquest.

It is difficult at present to say what riches the Moon will open to us, and in reality they may be found to be much richer than the best predictions. But the Moon will be very quickly used for studies of the Earth.

From the Moon, it will be possible to observe and study the exact patterns of the weather over the entire Earth. Other terrestrial phenomena will also be studied from the Moon and possibly controlled.

It will be possible to use the Moon for the retransmission of television broadcasts from any terrestrial station. Radio communication in the ultra-short-wave lengths and radio-navigation will become universal. ("The Seventh Continent," by Yu. Khlebstevich; Moscow, Znaniye-Sila, No 12, Dec 58, p 7)

Soviets Report Satellites Pass Through Meteor Shower; Meteor Danger Discussed

An article by V. Lutskiy, lecturer at the Moscow Planetarium, gives the following information on meteors and meteor danger in space travel.

Meteoric bodies especially came to the attention of scientists in connection with the launching of the artificial earth satellites and the first cosmic rocket. The problem of meteor danger arose for science. Investigations with the aid of geophysical rockets launched into the upper layers of the atmosphere indicated that the number of meteor bodies increased with altitude. Correspondingly, the danger of rocket craft encountering "celestial rocks" also increased.

The special piezo-elements, ammonium phosphate transducers carried by Sputnik III and the instrument container of the Soviet cosmic rocket which was launched 2 January were for the purpose of recording the impacts of micrometeorites.

The results of measurements with the aid of the satellite's instruments and numerous photographic, radar, and other observations made it possible to calculate the probability of the collision of a rocket craft having a total area of 100 square meters with meteor bodies of different size. A meteor body with a mass of one gram will be met only through 14,000 hours of flight; with a mass of 0.01 gram -- through 140 hours; and with a mass of 0.001 gram -- through 10 hours of flight. Meteor bodies in cosmic space occur much less frequently than previously supposed, and an inter-planetary craft could travel for many months or perhaps even years and still not encounter a large meteoric body.

However, there were times when the number of falling micrometeorites striking the piezo-elements increased sharply. Considerably temporary increases in the number of impacts, sometimes reaching several tens per second, were noted. This means that the satellite entered a dense meteor shower. Several showers (Perseids, Orionids, Leonids and others) are encountered by the Earth every year at certain times. The Earth, and with it the artificial earth satellites, passed through the Lyrids shower (so-called because its meteors originate in the constellation Lyra). The Earth passed through a maximum number of meteor bodies, which had a velocity of 46 kilometers per second, on 22 April.

The investigation of this and other meteor showers and isolated meteor bodies by using satellites and rockets, not only from the Earth, but also in interplanetary space itself, will enable scientists to give a truer picture of the cosmos and aid astronauts in the very near future to more surely guide space craft to other celestial bodies. ("Through Meteor Shower," by V. Lutskiy; Moscow, Izvestiya, 23 Apr 59, p 4)

Soviet Scientist Discusses Upper Atmosphere Findings

The Earth's atmosphere, at the beginning of the IGY, was sufficiently well studied only up to an altitude of 100 kilometers. Direct measurements of the density, pressure, temperature, and gas composition at high altitudes were very few, and representations of the upper atmosphere were rather poor. Conflicting hypotheses expounded by various scientists varied greatly.

Information on the upper atmosphere obtained by scientists with the aid of rockets and artificial Earth satellites radically changed conceptions concerning regions of the Earth's gaseous envelope which earlier were inacessable and for the first time, enabled them to determine the basic properties of the upper atmosphere up to altitudes of 800-1,000 kilometers.

Some of this information is presented by B. Danilin, Candidate of Technical Sciences, in an Izvestiya article.

Immediately after the launching of the first two Soviet artificial earth satellites, it was clear that the upper atmosphere has a considerably denser structure than previously imagined. Although these satellites carried no apparatus intended for directly measuring the density of the atmosphere, the braking of the satellites as a result of collisions with the molecules and atoms of gas, which was more sharply expressed in the lowest part of the orbit, made it possible to calculate the density of the atmosphere.

It was found that if density decreases sharply in the lower layers of the atmosphere with the increase of altitude and at 100 kilometers consists of one ten millionth part of the density of the air at ground level, then with a further increase in altitude the drop in density occurs more slowly. Braking of the satellites showed that at an altitude of 225 kilometers, the density was only 1,000 times less, and at an altitude of 268 kilometers decreased by only 1/20th.

The braking of a satellite makes it possible to calculate the atmospheric density only at the specific altitude corresponding to the region of the perigee. In connection with this, the results of direct measurements of density in a large interval of altitude, using manometers installed for the first time on Sputnik III, have great value.

Special highly-sensitive vacuum manometers were used for measuring the slight densities of the gaseous medium which are one hundred millionth and one billionth of the density of air at sea level. In these determinations of pressure or density in a free, undisturbed atmosphere, it is necessary to know precisely the orientation of the satellite in space at each moment.

It was found that at great altitudes, the density decreases slowly and that high temperature is inherent to the upper layers of the atmosphere. For example, at an altitude of 500 kilometers, the temperature of the medium reaches 1,500 degrees Kelvin. The reasons for such intense heating of the atmosphere are still not clear.

Previous to the launching of the artificial earth satellites, it was believed that the atmosphere expanded and contracted with heating by day and cooling at night and that its parameters changed markedly with geographic latitude. However, the launchings of high altitude rockets (including some in the polar regions) and investigations using satellites conducted during the IGY, alone, made it possible for the first time to establish regularities of these phenomena. It was discovered that the daytime summer values of density at an altitude of 200 kilometers were greater than the night winter values by almost 20 times and that the density of the atmosphere in the polar regions was 5 times greater than at this same altitude at the equator.

Other pulsations of the atmosphere were discovered. Observations indicated the braking of the satellites occurred irregularly. This means that the upper layers of the atmosphere are, at times, more rarefied and, at times, more dense and that the temperature of these layers correspondingly decreases or increases.

This phenomenon, obviously, is caused by a unique "breathing" of the atmosphere, during which it is intermittently contracted and then expanded. If the changes in the braking of the satellites (and, consequently, the pulsations of the atmosphere as well) and the activity of solar activity are plotted on one and the same graph, then the direct connection between changes in the properties of the upper atmosphere and the processes originating on the Sun is revealed.

It was known for a long time that a part of the molecules and atoms composing atmospheric gases in the higher altitudes occurred in an ionized state. However, even recently, it was not generally accepted that ionospheric formations have a stratified structure. Recent rocket investigations, and in particular the launching of the Soviet geophysical rocket to a record altitude of 473 kilometers in February 1958, did not support the existence of separate highly ionized layers. It has now been established that, beginning from an altitude of 60-70 kilometers, a continuous mass of ionized gas stretches up to the maximum altitude reached by a rocket. New information on the concentration of ions and electrons at great altitudes was obtained through the flights of rockets and satellites. For example, at an altitude of 800 kilometers, it was found that there are 160,000 ions per cubic centimeter. Such a considerable concentration of ions and also neutral particles (up to one million per cubic centimeter at an altitude of 700 kilometers) indicates that the upper limit of the Earth's air envelope is not at an altitude of 1,000 kilometers as was recently believed, but is even farther out, hardly occurring below 2,000, and is possibly even 3,000 kilometers. ("Breathing of the Atmosphere," by V. Danilin; Moscow, Izvestiya, 26 Apr 59, p 6)

Chiefs of Satellite Visual Observation Stations Hold Conference in Moscow

The All-Union Conference of the Chiefs of Artificial Earth Satellite Visual Observation Stations was held in Moscow 15-18 April. The conference was called by the Astronomical Council of the Academy of Sciences USSR. Seventy-two such stations are operating in different regions of the USSR since the launching of the first artificial earth satellite.

The conference was devoted to the exchange of the experience of observations and the presentation of the results of the work which was conducted during the past year. According to the opening address by A. G. Masevich, chairman of the Astronomical Council of the Academy of Sciences USSR, Soviet stations during 1958 gathered data from 23,500 observations of Sputniks I and II and also of Sputnik III's carrier rocket. In addition, material from 17,000 observations made by foreign stations has been received in the USSR.

Yu. V. Batrakov, senior scientific associate of the Institute of Theoretical Astronomy, Academy of Sciences USSR, presented a voluminous report on mathematical processing of observations and on the use of the results for scientific purposes. He cited, in particular, the graphics of the change in the orbital parameters of Sputnik III's carrier rocket, indicating the presence of considerably and irregular fluctuations in the density of the upper atmosphere. The degree of oblateness, which characterizes the shape of the Earth, was also more precisely determined on the basis of changes in the motion of the satellite over a period of time.

Certain characteristics of the orbits of interplanetary flights were presented by A. A. Mashkov, scientific associate. Prof V. P. Tsesevich of the Odessa Observatory reported in detail on the results of the study on the varying brightness of Sputnik III's carrier rockets. These changes characterize the orientation of an artificial celestial bodies in space and make it possible to determine the period of rotation and tumbling of the satellite around its transverse axis. An interesting mathematical theory for reducing data on the varying brightness of satellites was developed by Prof V. P. Tsesevich and V. M. Grigorev, aspirant.

The workers of the stations at the conference exchanged experiences on improvement in methodology. An instrument for automatically registering changes in the brightness of artificial earth satellites was built in the Rizhskiy station, which is headed by V. V. Shmeling. Apparatus for automatically registering the position of satellites was developed in the Tartu (Ya. E. Eynasto) and Kiev (N. A. Yakovkin) stations by means of which the accuracy of the observations is considerably increased.

The conference adopted a resolution in which the problems of work of the stations were noted. ("40,500 Observations," Pravda, 19 Apr 59, p 6)

III. UPPER ATMOSPHERE

Radio Echoes From Invisible Objects Tied to Weather Conditions

CPYRGHT

"It has frequently been stated that dialectical heterogeneities in the atmosphere can be the cause of the appearance of radar signals. The nature and structure of the sources of radio echoes of this type, however, have not yet been established.

"It occurred to us that some information could be obtained by investigating the characteristics of the signals and comparing them with meteorological conditions. With this purpose in mind, a regular radar sounding of the troposphere was conducted from 1956 to 1958 at the Central Aerological Observatory. The radar installation used in the sounding operates on a 3.2-centimeter wave and has a symmetric parabolic antenna-reflector 20 meters in diameter and a pulse power of about 100 kilowatts.

"Point sources of radio echoes, the height of which sometimes reached 7 kilometers, were repeatedly observed. At the same time, observers both on the earth and in balloons did not note any visible objects in the atmosphere. The results of the soundings were fixed by two different methods...."

The vertical distribution of the radio echoe sources was determined with respect to time and height, and the characteristics of the reflected signals were obtained by recording sequences of separate pulses from the radio echoes.

Several relationships between the sounding data and meteorological conditions, such as ground temperature, season of the year, time of day, and wind velocity, were observed. ("Radio Echoes From Certain Invisible Objects in the Troposphere," by A. G. Gorelik and V. V. Kostarev, Central Aerological Observatory; Moscow, Doklady Akademii Nauk SSSR, Vol 125, No 1, 1 Mar 59, pp 59-61)

China's Plans for Solar Research

An item in a Chinese scientific periodical reports that a national Solar Research Conference was held in Nanking early in October 1958. It was recommended at the conference that solar research groups strive within the next 3 years to attain proficiency in forecasting short period solar activity and to elucidate the phenomena related to secular solar activity.

The conference also decided to concentrate most of its 1958-1959 efforts in the production of some essential precision instruments, including the following: a solar telescope with a 60-centimeter aperture and accessory spectrographs; a diffraction grating with an area of more than 15 x 15 square centimeters and 600 lines per millimeter; a white light coronagraph; a monochromatic light filter; and a magnetic quadrant.

("Breaking Through the Forefront Positions of Solar Research," Solar Research Group, Tzu-chin Shan Observatory, Academia Sinica; Peiping, K'o-hsueh T'ung-pao (Scientia), No 1, 1959)

Auroral Observations in China

An article in the T'ien-ch'i Yueh-k'an, a Chinese weather monthly, describes northern lights lasting 44 minutes as seen from the authors station (49 07 N 125 39 E, 312 meters above sea level) on 4 December 1958. ("Aurora Observed Again From Our Station," by Wu Chihpch'iang and Chang Kuei-jung, Nonni River Ho-chia P'ao-tzu Climatological Station; Peiping, T'ien-ch'i Yueh-K'an (Weather Monthly), No 1, 1959, p 38)

IV. GEOMAGNETISM

Zarya Leaves on New Expedition; Cosmic Ray Studies To Be Conducted for First Time

The Zarya, nonmagnetic ship of the Scientific Research Institute of Terrestrial Magnetism, the Ionosphere and Radiowave Propagation (NIZMIR), sailed from Odessa on 26 April on a new expedition which will cover 30,000 miles.

According to Boris Aleksandrovich Bologov, Candidate of Physicomathematical Sciences, chief of the expedition, the Zarya will visit a number of Soviet ports in the Azov and Black Seas in the course of a month, and then, after replenishing its supplies in Odessa, it will conduct a magnetic survey in the Indian and Pacific oceans. The Zarya will visit ports in India and Indonesia, New Zealand, and the the islands of Samoa and Fiji. It will proceed to Vladivostok via Shanghai and Tokyo.

The Zarya remained in the port of Tuapse the entire winter, being readied for its voyage.

The ship is equipped with the latest magnetometers, the operation of which is based on the principal of proton resonance. Instruments for ionospheric investigations and the study of the intensity of cosmic rays have been placed on board for the first time. ("Around the Gigantic Magnet," by O. Stroganov; Moscow, Izvestiya, 26 Apr 59, p 6)

V. ARCTIC AND ANTARCTIC

Press Conference on Arctic and Antarctic

The State Committee for Cultural Relations with Foreign Countries under the Council of Ministers USSR held a press conference for Soviet and foreign journalists on 22 April. The conference was devoted to Soviet scientific research in the Arctic and Antarctic and was attended by Ye. I. Tolstikov, chief of the Third Antarctic Expedition; M. I. Shevelev, deputy chief of Glavsevmorput' (Main Administration of the Northern Sea Route); Prof N. N. Zubov; N. A. Belov, chief of drift station Severnyy Polyus-7; V. M. Perov, polar aviator; and S. I. Golovin, deputy chief of Glavsevmorput'.

Ye. I. Tolstikov gave a report on the work of Soviet scientists in the Arctic and Antarctic. He reported in detail on the research conducted in Antarctica under the IGY program, on the continental traverses by sled-tractor trains, and on the establishment of Soviet scientific stations at the south geomagnetic pole and the pole of relative inaccessibility Ye. I. Tolstikov emphasized in his report that, as a result of the close contact among scientists of many countries, new material has been obtained which has widened the scope of information available on the nature of Antarctica.

N. A. Belov, chief of station Severnyy Polyus-7, reported on the scientific observations during the annual drift in high latitudes. V. M. Perov, commander of the air detachment of the Third Antarctic Expedition, reported on the flights made by Soviet pilots in Antarctica and the rescue of the Belgian scientists on Queen Maud Land.

The journalists asked a number of questions, which were answered in detail. ("Polar Workers Report..."; Moscow, Vodnyy Transport, 23 Apr 59)

New Soviet Drift Station Established

A radiogram was received in Moscow from M. M. Nikitin, head of the high-latitude air expedition "Sever-11." He reported that the search for an ice floe to carry the new Soviet drift station Severnyy Polyus-8 had been completed. The crews of the planes piloted by P. P. Moskalenko, Ya. Ya. Dmitriyev, and M. G. Zav'yalov discovered an old ice field is about 3 meters thick. I. P. Romanov, hydrologist, took part in the reconnaissance flight.

Polar Aviation planes have begun the transport of huts, scientific equipment, food supplies, and other items to the ice floe. The first group of scientists of the new drift station, headed by V. M. Rogachev, arrived on the ice floe a few days ago. After inspecting the ice floe, the polar workers began setting up the station. ("Station SP-8 is Being Established"; Moscow, Vodnyy Transport, 21 Apr 59)

Exploration of Queen Maud Land Mountains

One of the largest mountain systems of Antarctica is the one on Queen Maud Land, extending almost 1,000 kilometers from 18 degrees E to 8 degrees W. These mountains have been explored only to a small degree. Only the western fringe of these mountains was visited by geologists of the Norwegian-British-Swedish expedition of 1949-1952. Somewhat earlier, in 1939, a German expedition took aerial photographs of the mountains and compiled maps, which disclosed that some of the individual peaks rise to almost 4,000 meters above sea level and 1,000 meters above the ice sheet. P. Voronov, L. Klimov, and D. Solov'yev, geologists, and Prof M. Ravich, Doctor of Geological and Mineralogical Sciences, who are members of the Fourth Antarctic Expedition, were anxious to begin explorations of the eastern part of the unexplored mountain region.

The first glimpse of these mountains was obtained when the expedition ship Ob' approached the shelf ice of Queen Maud Land on 10 February, at a point approximately 70 degrees S and 13 degrees E. Individual pyramidal peaks were clearly outlined in the distance. During subsequent reconnaissance flights, more and more of the magnificent mountainous panorama was disclosed. The undulating mountain plateau dropped precipitously, in the form of 400-meter vertical cliffs, straight down to the ice sheet. High conical peaks, resembling sharpened pencils, could be seen.

During one of the flights, a large number of mountain peaks were discovered between 72 degrees S and 17 to 19 degrees E. The Soviet explorers named them the Russian Mountains. In the center of them was Gora Zhelannaya [Mt. Desire ?], which attracted attention by its complex geological structure.

L. Zotov, the pilot, found a suitable spot for a landing on the snow-covered slope. The party got out of the plane and was immediately knocked off their feet by the sharp, cold wind. It was a bright, sunny day, but violently drifting snow was seen at an altitude of 2,000 meters. The temperature was minus 20 degrees centigrade, and the wind velocity, 70 kilometers per hour. Despite the piercing cold and wind, the expedition party climbed to the top of the mountain. After collecting samples of various types of rocks, the geologists returned to the plane. Meanwhile, Antonin Mkros, the Czech astronomer, had completed the determination of the astronomical point. The location of Gora Zhelannaya was determined fairly accurately.

The area where rocks appear through the ice has been studied in detail. An "oasis" in Princess Astrid Coast is located at the edge of the continent, where it borders on the shelf ice, and extends for almost 15 kilometers in a latitudinal direction. This "oasis" is formed by groups of small hills, separated by wide valleys; shallow lakes are found on the bottom of these depressions. Nunataks, i. e., isolated rocky elevations rising 50-300 meters above the ice sheet, were observed between the "oasis" and the mountains.

The mountain region of Queed Maud Land has apparently twice experienced a period of glaciation. The oldest glaciation period appears to have been the strongest. Its traces were found on the slopes of a number of mountains at an elevation of 500-700 meters above the level of the present glaciers. The mountain area is not devoid of life. Even at the end of the antarctic summer, the sun warms the surface of the rocks to a temperature of 10 degrees centigrade. As a result, patches of green moss and orange-colored lichens appear on the rocky surface. The lichens were found at elevations of 2,500-2,700 meters.

Storms, purgas, and heavy winds frequently interrupted the exploration of this mountain region. The explorers had to remain for several days in their tents, which barely withstood the driving force of the wind. As soon as the wind died down, explorations were continued. As a result, the group of geologists collected interesting materials, characteristic of the relief and geological structure of the eastern part of Queen Maud Land. ("In the Unknown Mountains"; Moscow, Vodnyy Transport, 18 Apr 59)

Fall Weather on Queen Maud Land

The antarctic fall has begun at the new station Lazarev on Queen Maud Land. The air temperature is minus 10-20 degrees centigrade, and there are frequent cyclones, accompanied by heavy winds. Sometimes the winds reach a velocity of over 50 meters per second. Much snow has fallen. On the fourth day after the station was established, some of the buildings were snowed in up to their roofs. ("Fall Has Set In"; Moscow, Vodnyy Transport, 19 Mar 59)

Ob' Returns to Murmansk

The expedition ship Ob', after completing its return voyage from the Antarctic, arrived in Murmansk on 20 April. ("Ob' in Murmansk"; Moscow, Vodnyy Transport, 21 Apr 59)

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